

What Is Claimed Is:

1. A measuring circuit which measures a parameter of a time-base error of a pulse train, the measuring circuit comprising:

a phase-locked loop including a phase comparator and a variable frequency oscillator, wherein the phase comparator compares phases of an inputted pulse train and a clock signal based on an oscillation output of the variable frequency oscillator to output a phase error signal, and wherein an oscillation frequency of the variable frequency oscillator is variably controlled in correspondence with the phase error signal so as to allow the clock signal to be synchronized with the pulse train;

an absolute value circuit which determines absolute values of phase errors consecutively outputted from the phase comparator; and

an average value circuit which determines an average value of the absolute values of the phase errors which are consecutively determined, or which determines a value corresponding to the average value,

wherein the value determined by the average value circuit is outputted as a measured value of a parameter of a time-base error of the pulse train.

2. The measuring circuit according to claim 1, wherein the average value circuit determines an average

8 pulse train and a clock signal based on an oscillation
9 output of the variable frequency oscillator to output
10 a phase error signal, and wherein an oscillation
11 frequency of the variable frequency oscillator is
12 variably controlled in correspondence with the phase
13 error signal so as to allow the clock signal to be
14 synchronized with the pulse train;

15 an absolute value circuit which
16 determines absolute values of phase errors
17 consecutively outputted from the phase comparator;
18 and

19 an average value circuit which
20 determines an average value of the absolute values
21 of the phase errors which are consecutively determined,
22 or which determines a value corresponding to the average
23 value,

24 wherein the value determined by the
25 average value circuit is outputted as a measured value
26 of a parameter of a time-base error of the pulse train;

27 a beam-power adjusting circuit which adjusts
28 recording beam power of a laser beam; and

29 a control circuit which controls such that test
30 recording is effected with respect to an optical disk
31 while consecutively varying the recording beam power
32 of the laser beam prior to the recording of the optical
33 disk, the test recording is reproduced after the test
34 recording, a value of the parameter of the time-base

35 error of the reproduced pulse train is measured by
36 the measuring circuit, an appropriate value of the
37 recording beam power of the laser beam during actual
38 recording is determined on the basis of the measured
39 value, and the recording beam power of the laser beam
40 is set to the appropriate value so as to effect actual
41 recording.

1 6. The optical disk recording apparatus according
2 to claim 5, further comprising:

3 a pulse-train reproducing circuit which
4 reproduces a pulse train corresponding to a recording
5 laser-beam drive signal from a return-light reception
6 signal of the recording laser beam,

7 wherein, during actual recording, the control
8 circuit controls such that the value of the parameter
9 of the time-base error of the pulse train reproduced
10 by the pulse-train reproducing circuit is measured
11 by the measuring circuit, and the recording beam power
12 of the laser beam is consecutively corrected to an
13 appropriate value in real time on the basis of the
14 measure value.

1 7. The optical disk recording apparatus according
2 to claim 5, wherein the average value circuit determines
3 an average value of the absolute values of the phase
4 errors at all edges of the pulse train, or determines

5 a value corresponding to the average value.

1 8. The optical disk recording apparatus according
2 to claim 5, wherein the average value circuit includes
3 an accumulator which consecutively accumulates the
4 absolute values of the phase errors, and which
5 determines an accumulated value within a predetermined
6 time duration as the value corresponding to the average
7 value of the absolute values of the phase errors.

1 9. The optical disk recording apparatus according
2 to claim 7, wherein the average value circuit includes
3 an accumulator which consecutively accumulates the
4 absolute values of the phase errors, and which
5 determines an accumulated value within a predetermined
6 time duration as the value corresponding to the average
7 value of the absolute values of the phase errors.

1 10. A measuring circuit which measures a parameter
2 of the time-base error of a pulse train, the measuring
3 circuit comprising:

4 a phase-locked loop including a phase comparator
5 and a variable frequency oscillator, wherein the phase
6 comparator compares phases of an inputted pulse train
7 and a clock signal based on an oscillation output of
8 the variable frequency oscillator to output a phase
9 error signal, and wherein an oscillation frequency

of the variable frequency oscillator is variably controlled in correspondence with the phase error signal so as to allow the clock signal to be synchronized with the pulse train; and

an average value circuit which determines an average value of phase errors consecutively outputted from the phase comparator, or which determines a value corresponding to the average value,

wherein the value determined by the average value circuit is outputted as a measured value of the parameter of the time-base error of the pulse train.

11. The measuring circuit according to claim 10, wherein the average value circuit includes an accumulator which consecutively accumulates the phase errors, and which determines an accumulated value within a predetermined time duration as the value corresponding to the average value of the phase errors.

12. The measuring circuit according to claim 10, wherein the pulse train has a signal representing digital information on the basis of its pulse length, and the measuring circuit further comprises:

a pulse-length discriminating circuit which discriminates a pulse length of one of a pit-corresponding pulse and a blank-corresponding pulse of the pulse train,

wherein the average value circuit determines the average value of the phase error at one of a leading edge and a trailing edge of the pit-corresponding pulse, or determines a value corresponding to the average value.

13. The measuring circuit according to claim 12, wherein the average value circuit includes an accumulator which consecutively accumulates the phase errors, and which determines an accumulated value within a predetermined time duration as the value corresponding to the average value of the phase errors.

14. The measuring circuit according to claim 10, wherein the pulse train has a signal representing digital information on the basis of its pulse length, and the measuring circuit further comprises:

a pulse-length discriminating circuit which discriminates a pulse length of one of a pit-corresponding pulse and a blank-corresponding pulse of the pulse train,

wherein the average value circuit determines the average value of the phase error at one of a leading edge and a trailing edge of the blank-corresponding pulse, or determines a value corresponding to the average value.

51 with appropriate beam power, the amounts of time-base
52 correction of the recording laser-beam drive signal
53 during actual recording are determined for the
54 respective pulse lengths on the basis of the measured
55 values of the parameter of the time-base error, and
56 the amounts of time-base correction of relevant
57 portions of the recording laser-beam drive signal are
58 respectively set to those values so as to effect actual
59 recording.

1 19. The optical disk recording apparatus according
2 to claim 18, wherein the average value circuit includes
3 an accumulator which consecutively accumulates the
4 phase errors, and which determines an accumulated value
5 within a predetermined time duration as the value
6 corresponding to the average value of the phase errors.

1 20. An optical disk recording apparatus, comprising:
2 a measuring circuit which measures a parameter
3 of the time-base error of a pulse train, the measuring
4 circuit comprising:
5 a phase-locked loop including a phase
6 comparator and a variable frequency oscillator, wherein
7 the phase comparator compares phases of an inputted
8 pulse train and a clock signal based on an oscillation
9 output of the variable frequency oscillator to output
10 a phase error signal, and wherein an oscillation

11 frequency of the variable frequency oscillator is
12 variably controlled in correspondence with the phase
13 error signal so as to allow the clock signal to be
14 synchronized with the pulse train; and

15 an average value circuit which
16 determines an average value of phase errors
17 consecutively outputted from the phase comparator,
18 or which determines a value corresponding to the average
19 value,

20 wherein the value determined by the
21 average value circuit is outputted as a measured value
22 of the parameter of the time-base error of the pulse
23 train, and

24 wherein the pulse train has a signal
25 representing digital information on the basis of its
26 pulse length, and the measuring circuit further
27 comprises:

28 a pulse-length discriminating circuit which
29 discriminates a pulse length of one of a
30 pit-corresponding pulse and a blank-corresponding
31 pulse of the pulse train,

32 wherein the average value circuit determines
33 the average value of the phase error at one of a leading
34 edge and a trailing edge of the blank-corresponding
35 pulse, or determines a value corresponding to the
36 average value;

37 a time-base correcting circuit which corrects

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within a predetermined time duration as the value corresponding to the average value of the phase errors.

22. A measuring circuit which measures a parameter of a time-base error of a pulse train, the measuring circuit comprising:

a phase-locked loop including a phase comparator and a variable frequency oscillator, wherein the phase comparator compares phases of an inputted pulse train and a clock signal based on an oscillation output of the variable frequency oscillator to output a phase error signal, and wherein an oscillation frequency of the variable frequency oscillator is variably controlled in correspondence with the phase error signal so as to allow the clock signal to be synchronized with the pulse train;

an absolute value circuit which determines absolute values of phase errors consecutively outputted from the phase comparator;

a first average value circuit which determines an average value of the absolute values of the phase errors which are consecutively determined, or which determines a value corresponding to the average value; and

a second average value circuit which determines an average value of phase errors consecutively outputted from the phase comparator, or which

25 determines a value corresponding to the average value,
26 wherein the values determined by the first average
27 value circuit and the second average value circuit
28 are respectively outputted as measured values of first
29 and second parameters of the time-base error of the
30 pulse train.

1 23. An optical disk recording apparatus, comprising:
2 a measuring circuit which measures a parameter
3 of a time-base error of a pulse train, the measuring
4 circuit comprising:

5 a phase-locked loop including a phase
6 comparator and a variable frequency oscillator, wherein
7 the phase comparator compares phases of an inputted
8 pulse train and a clock signal based on an oscillation
9 output of the variable frequency oscillator to output
10 a phase error signal, and wherein an oscillation
11 frequency of the variable frequency oscillator is
12 variably controlled in correspondence with the phase
13 error signal so as to allow the clock signal to be
14 synchronized with the pulse train;

15 an absolute value circuit which
16 determines absolute values of phase errors
17 consecutively outputted from the phase comparator;

18 a first average value circuit which
19 determines an average value of the absolute values
20 of the phase errors which are consecutively determined,

or which determines a value corresponding to the average value; and

a second average value circuit which determines an average value of phase errors consecutively outputted from the phase comparator, or which determines a value corresponding to the average value,

wherein the values determined by the first average value circuit and the second average value circuit are respectively outputted as measured values of first and second parameters of the time-base error of the pulse train;

a beam-power adjusting circuit which adjusts recording beam power of a laser beam;

a time-base correcting circuit which corrects time base of a recording laser-beam drive signal; and

a control circuit which controls such that an amount of time-base correction of the recording laser-beam drive signal is set to a predetermined tentative value prior to recording of an optical disk, test recording is effected with respect to the optical disk while consecutively varying the recording beam power of the laser beam, the test recording is reproduced after the test recording, a value of the first parameter of the time-base error of the reproduced pulse train is measured by the measuring circuit, an appropriate value of the recording beam power of the laser beam

48 during actual recording is determined on the basis
49 of the measured value, a value of the second parameter
50 of the time-base error of the reproduced pulse train
51 is measured by the measuring circuit with respect to
52 the test recording recorded with appropriate beam power,
53 the amount of time-base correction of the recording
54 laser-beam drive signal during actual recording is
55 determined on the basis of the measured value, the
56 recording beam power of the laser beam is set to the
57 appropriate value, and the amount of time-base
58 correction of the recording laser-beam drive signal
59 is set to the value so as to effect actual recording.

1 24. A measuring circuit for measuring a parameter
2 of a time-base error of a pulse train, the measuring
3 circuit comprising:

4 a phase-locked loop including:

5 variable frequency oscillating means, and
6 phase comparing means for comparing phases
7 of an inputted pulse train and a clock signal based
8 on an oscillation output of the variable frequency
9 oscillating means to output a phase error signal,

10 wherein an oscillation frequency of the variable
11 frequency oscillating means is variably controlled
12 in correspondence with the phase error signal so as
13 to allow the clock signal to be synchronized with the
14 pulse train;

21 or determining a value corresponding to the average
22 value; and

23 second average value determining means for
24 determining an average value of phase errors
25 consecutively outputted from the phase comparing means,
26 or determining a value corresponding to the average
27 value,

28 wherein the values determined by the first average
29 value determining means and the second average value
30 determining means are respectively outputted as
31 measured values of first and second parameters of the
32 time-base error of the pulse train.